

US 29 / 15/ 17 Interchange Study

Fauquier County, Virginia



This interchange study explores the feasibility of constructing an interchange at the existing at-grade intersection of Route 29/15/17 with Business Route 29/15/17 & Lord Fairfax Road just at the southern edge of the Town of Warrenton in Fauquier County.

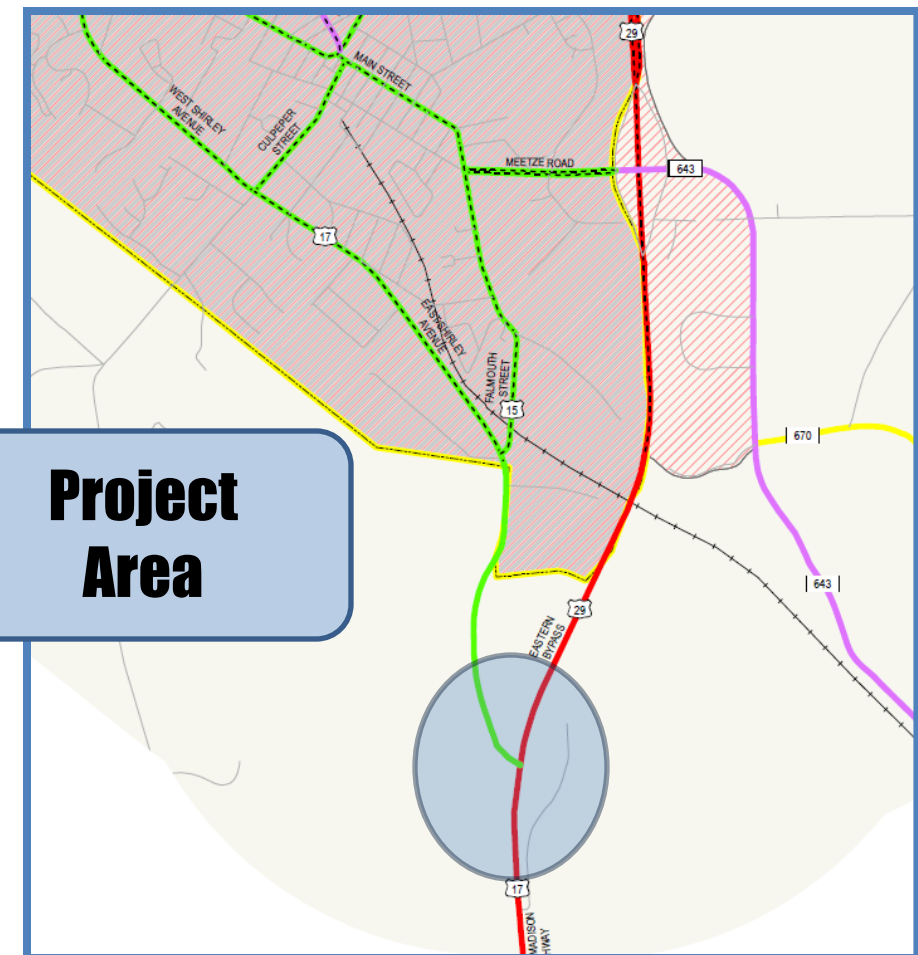
Route 29 is a major north-south route in Virginia spanning 248 miles from the North Carolina State Line in Danville to the Key Bridge in Washington D.C. The portion from Danville to Warrenton is known as the Seminole Trail. Through the project areas, US 29 is co-located with US Route 15 and US Route 17.

Route 29 is a principal arterial. South of the project intersection, Route 29 is four-lane highway with at-grade intersections. North of the project intersection, Route 29 is a limited access bypass of Warrenton with grade separations. Business Route 29 is classified as a minor arterial while Lord Fairfax Way is not federally classified and thus a local road.

Existing Intersection

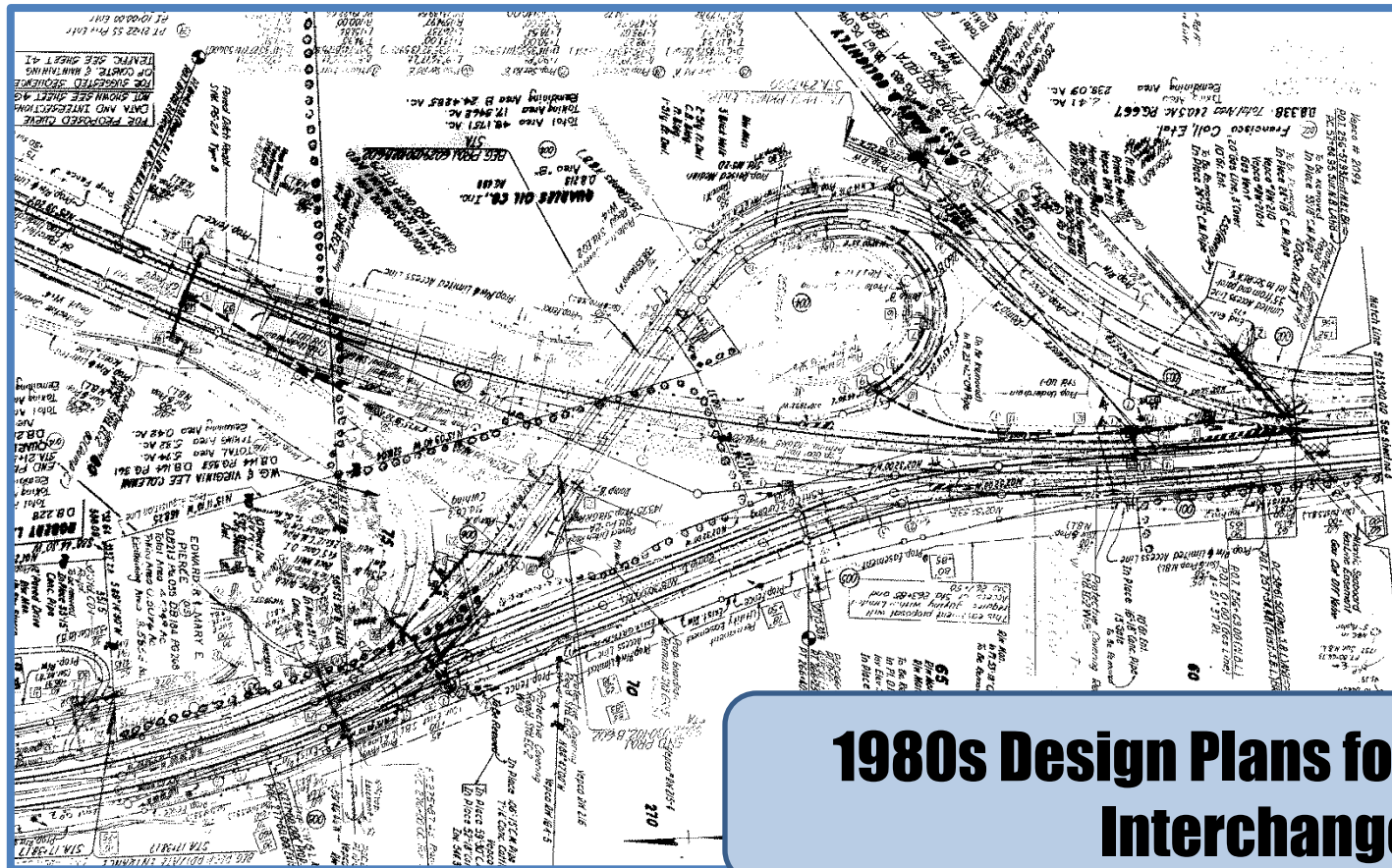


Project Area



When the Route 29 Bypass was constructed in the early 1980's, an interchange was explored at this intersection. Several designs were considered including a full cloverleaf and Route 29 on new alignment.

However, ultimately a trumpet interchange design was chosen and limited access right-of-way was acquired in the 1990's.



1980s Design Plans for a Trumpet Interchange



1980s Original Interchange Concepts

Recently VDOT explored several preliminary interchange alternatives for this intersection utilizing the existing right-of-way as much as possible. Four distinct alternatives were developed and compared.

Alternative 1



Alternative 2



Alternative 3

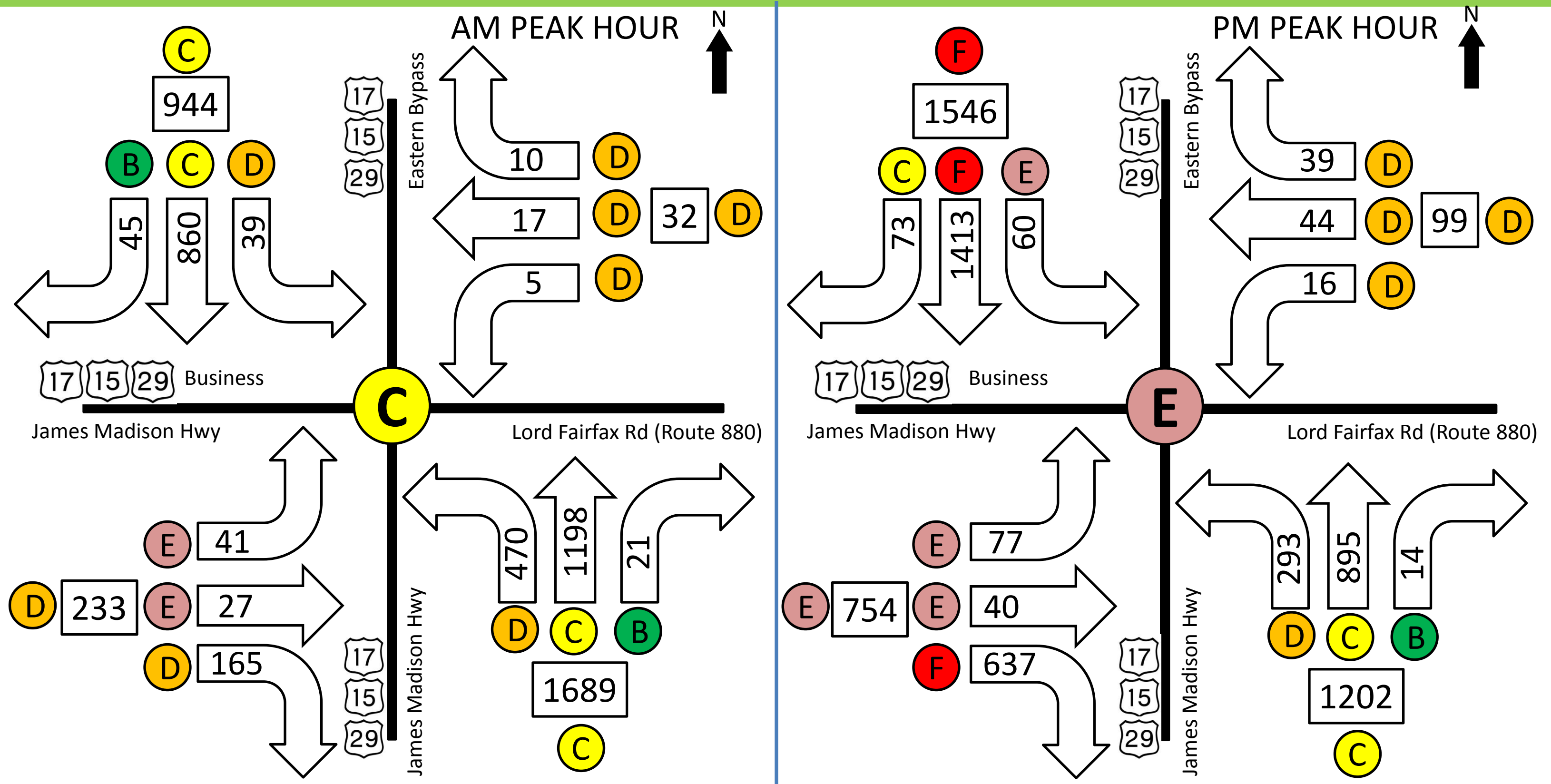


Alternative 4



Comparison Matrix

Alternatives	Description	Criteria				
		Traffic pattern changes	MOT during construction	ROW Impacts	Cost Estimate	Comments
1	Connects College St. under Route 29 at the current location.	All movements are included at the interchange	Will require relocating Route 29, Bus 15/29-College St., and the current intersection. Will require many Phases.	Large portions of the temporary construction easement to the west will be required to accommodate the relocated roads and intersection during construction. There may be some ROW required depending on the ramp configuration.		Blasting and Rock Excavation will be extensive for this alternative.
2	Connects College St. over Route 29 just south of current Intersection.	All movements are included at the interchange	Will require shifting the intersection and the Bus15/29 College St. approaches slight northward in order to build the new bridge approaches and ramps (requires minimum 2-3 phases)	There may not be any ROW impacts with this alternative depending on the bridge and approach design.	\$26.434 Mil	
3	Connects College St. over Route 29 just south of current Intersection.	The NB off ramp is separated from the interchange.	Will require some lane shifts and temporary pavement in order to build the approach tie-ins and ramps (requires minimum 3 phases)	The NB off ramp will require additional ROW, However this ramp could be a temporary ramp and then relocated in phase 3 to the interchange.	\$23.468 Mil.	The separated NB ramp may require additional improvements to existing College St. that are not included in the project cost.
4	Connects College St. over Route 29 just south of current Intersection.	All movements are included at the interchange	Will require some lane shifts and temporary pavement in order to build the approach tie-ins and ramps (requires minimum 3 phases)	In this scenario there will be some ROW need for the SB On/Off-ramps, however this could be eliminated if the diamond configuration is used as shown in Alternative 3. There maybe some cost savings in the latter case.	\$27.442 Mil.	



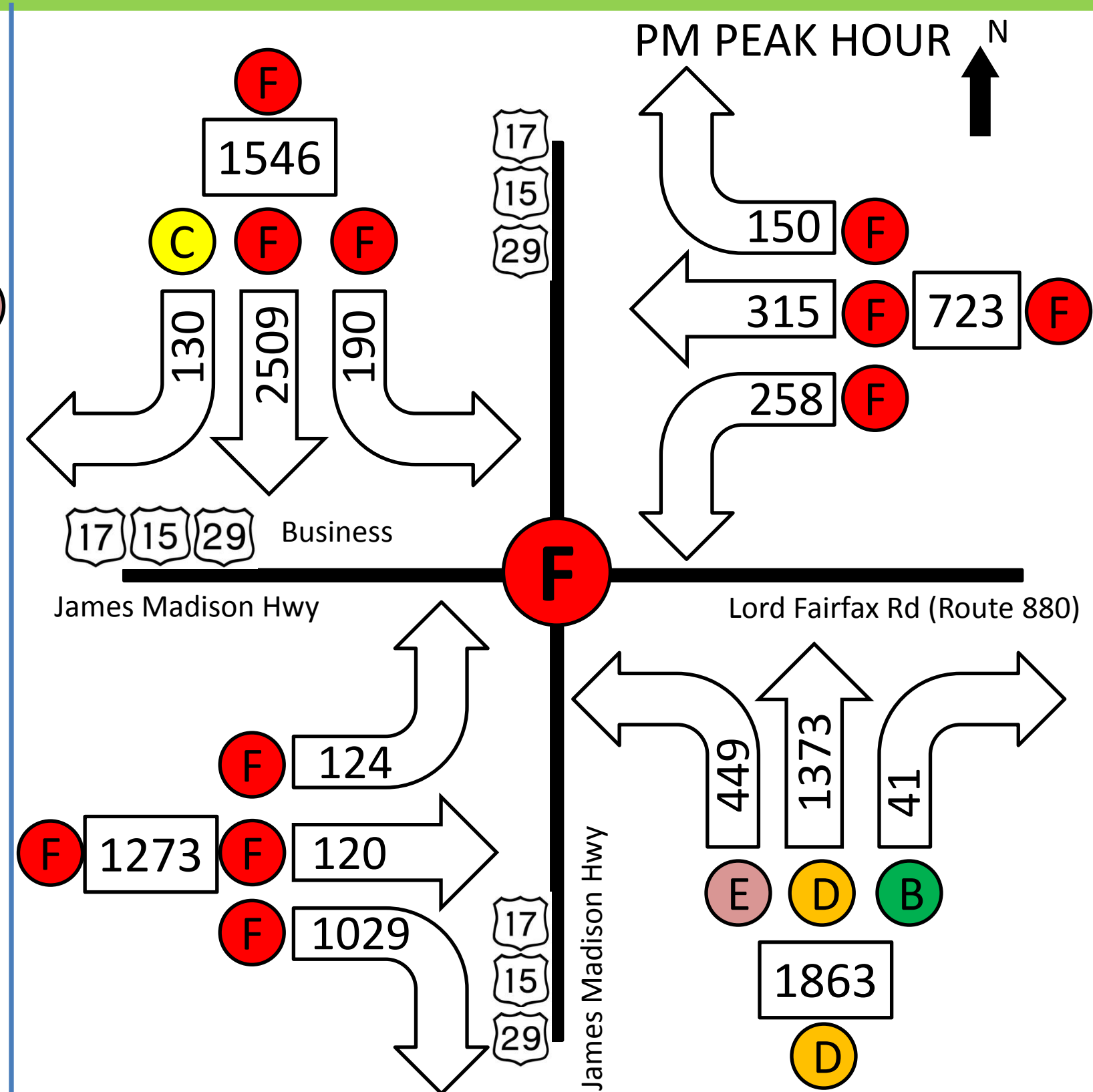
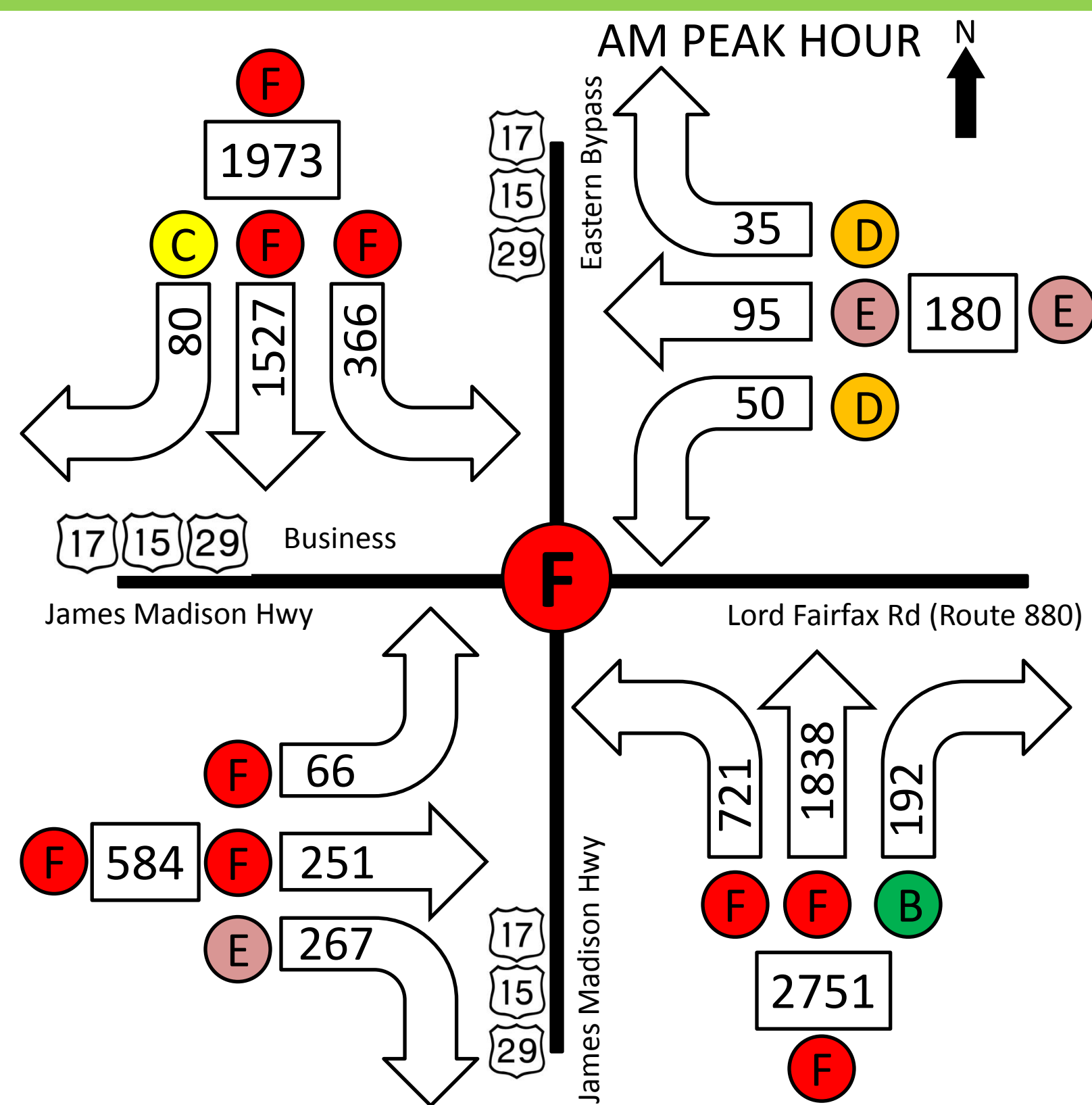
Traffic volumes for design year 2040 were developed by applying historic trend growth rates to existing counts and adding additional traffic associated with the planned Arrington Property Development.

2040 Design Year Volumes

Route	2010 VPD	2040 VPD	% Trucks
US 15-17-29	43,400	74,100	9%
US 15-17-29 Bypass	39,700	68,100	9%
Bus 15-17-29	10,500	15,700	2%
Route 880	3,100	19,300	6%

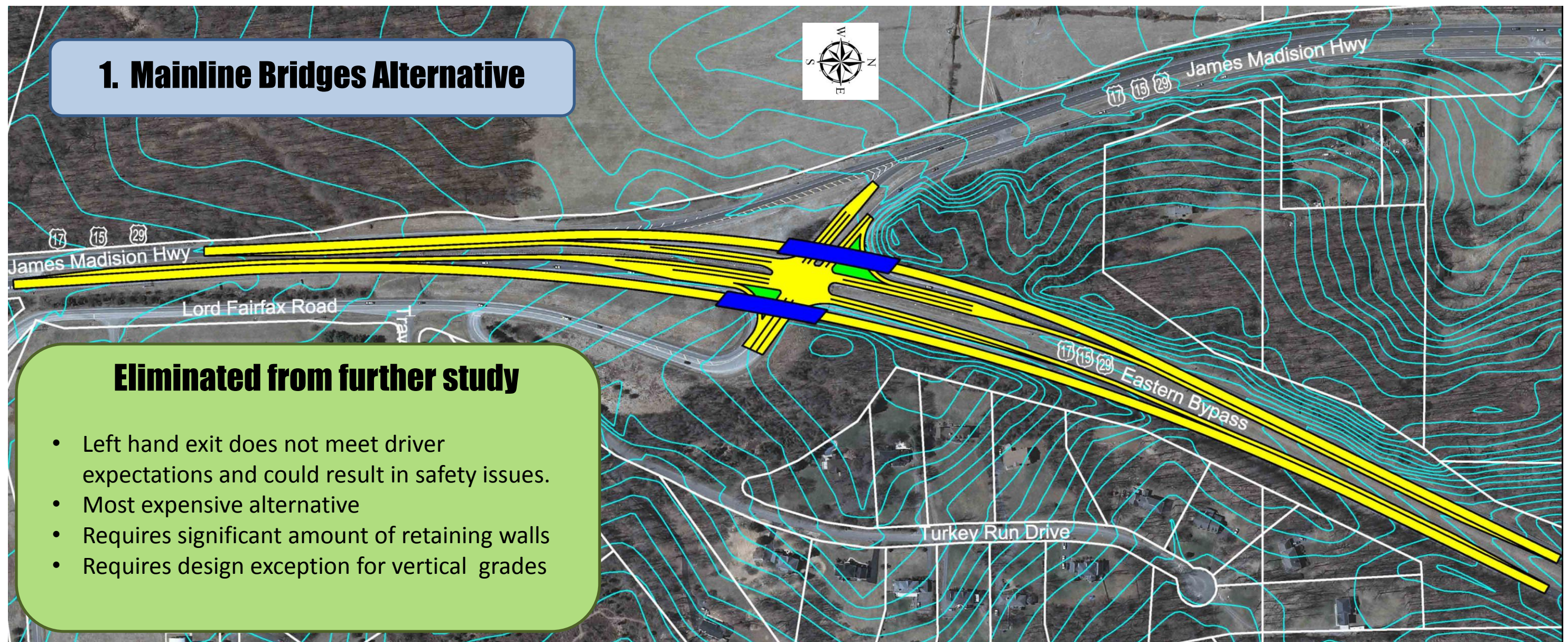


FUTURE 2040 NO-BUILD TRAFFIC CONDITIONS

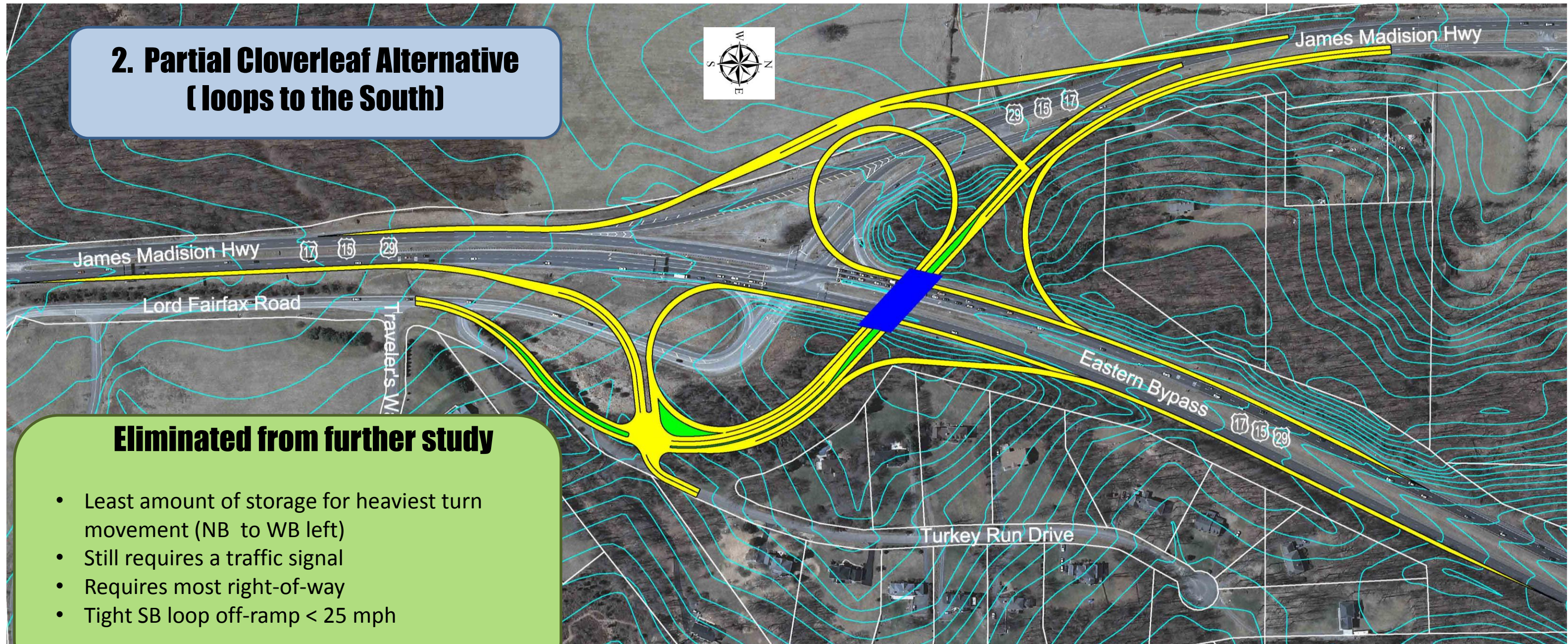


Based on the previous VDOT developed alternatives and consideration for the future traffic demand, Baker developed five preliminary interchange concepts for the project.

Three of the five alternatives were eliminated from further consideration and two advanced for further study. The three eliminated include:



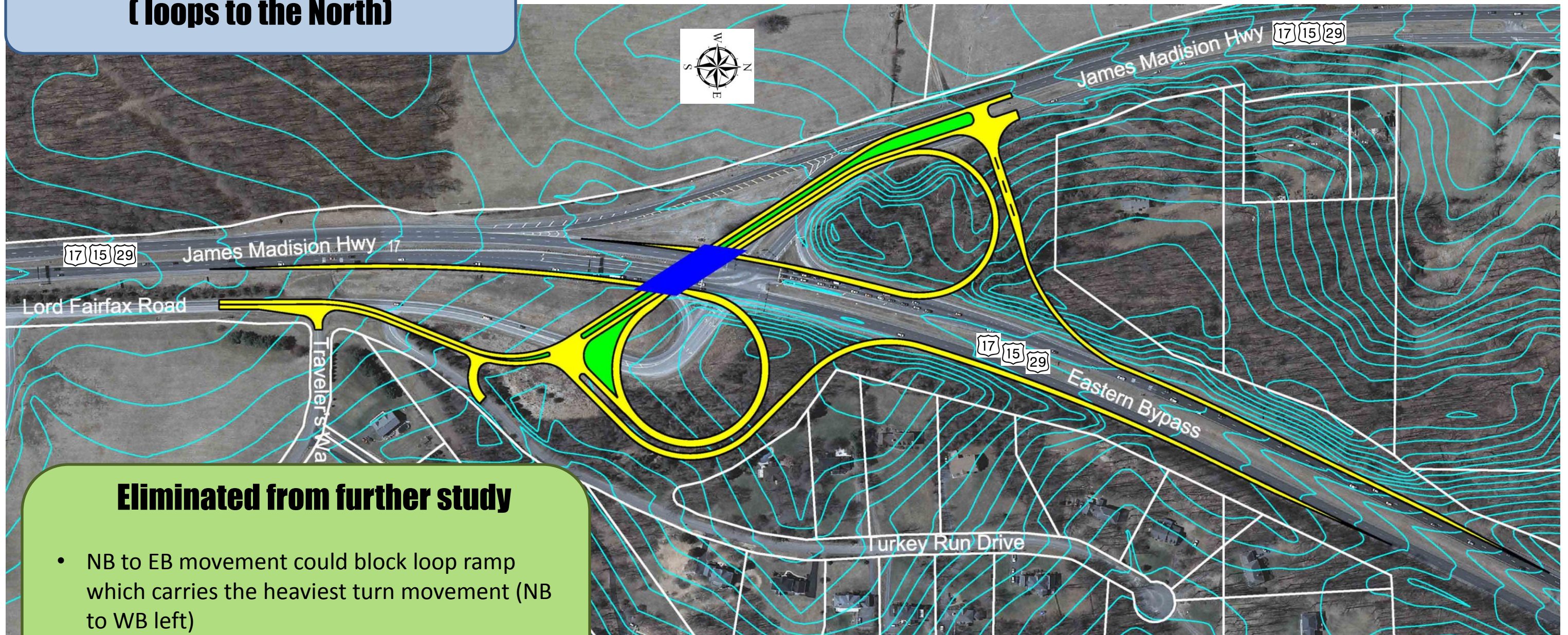
2. Partial Cloverleaf Alternative (loops to the South)



Eliminated from further study

- Least amount of storage for heaviest turn movement (NB to WB left)
- Still requires a traffic signal
- Requires most right-of-way
- Tight SB loop off-ramp < 25 mph

3. Partial Cloverleaf Alternative (loops to the North)



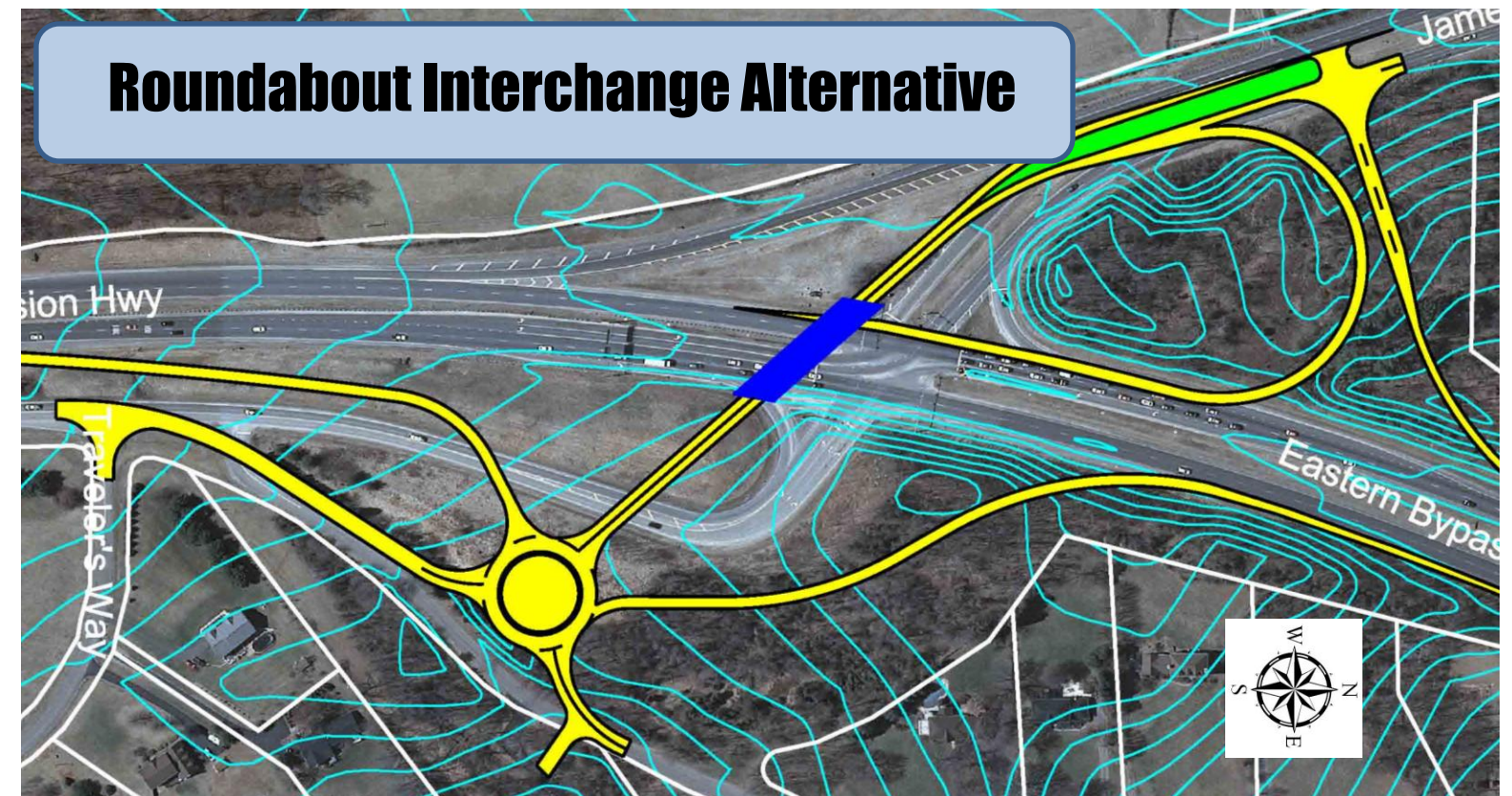
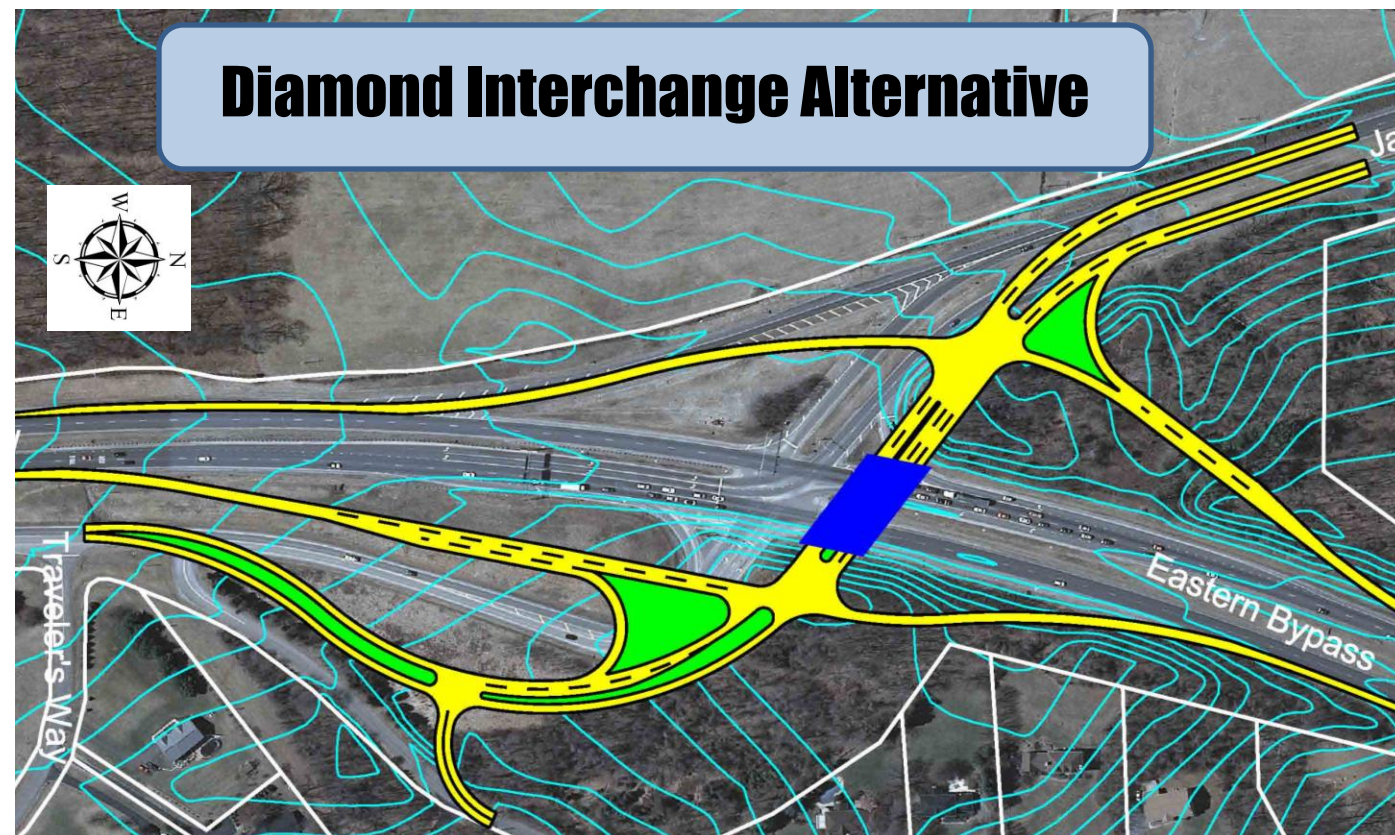
Eliminated from further study

- NB to EB movement could block loop ramp which carries the heaviest turn movement (NB to WB left)
- Still requires a traffic signal
- Tight NB loop off-ramp < 25 mph

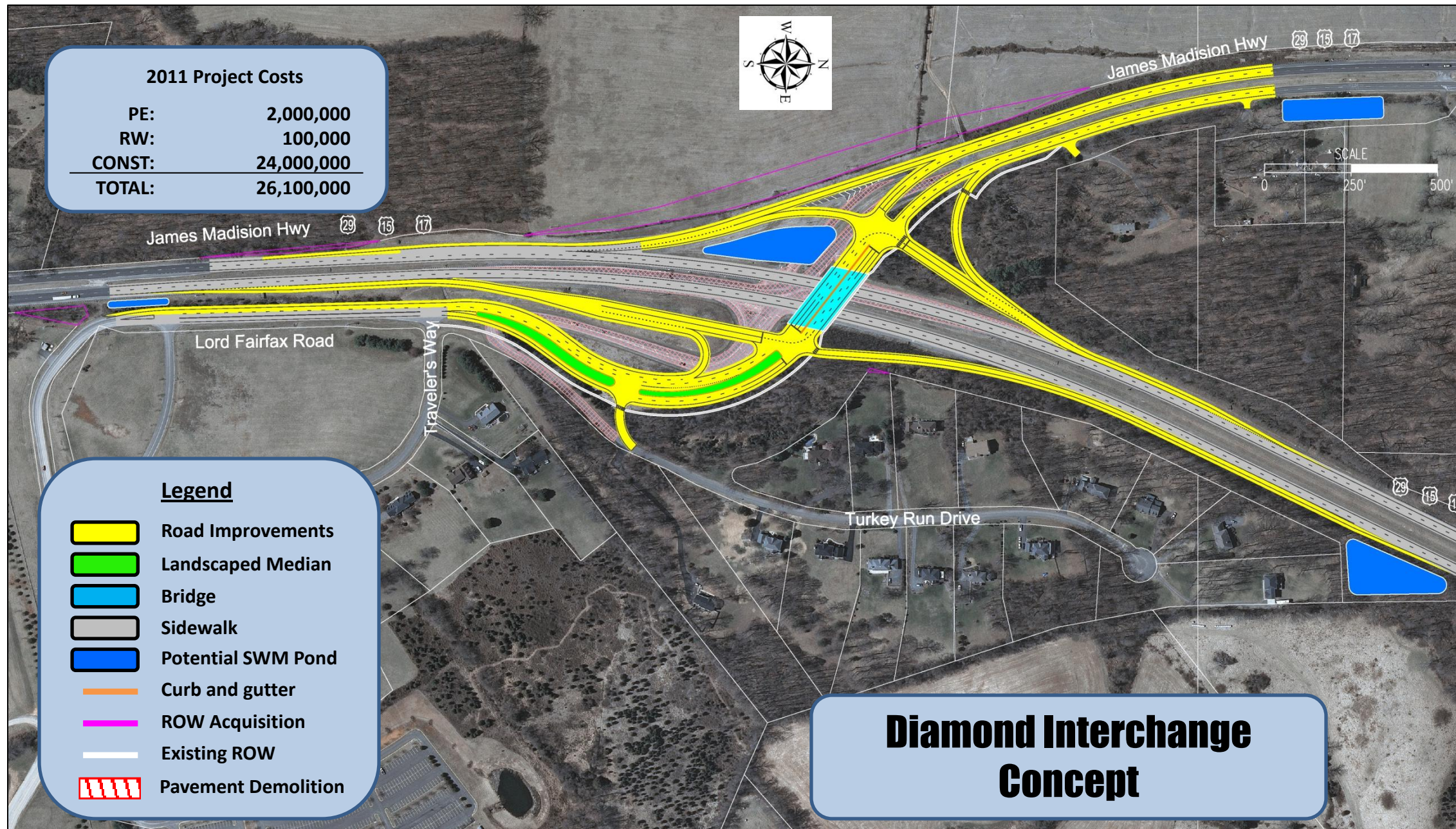
This Interchange Study carried two alternatives forward for further study. For each alternative concept the geometric layout, operational functionality, right-of-way impacts, constructability, and costs were analyzed.

The concepts were re-designed to carry the 2040 forecast traffic volumes for the project area. The cross-street has a design speed of ≥ 40 mph and the ramps a design speed of ≥ 25 mph.

The two preliminary alternatives carried forward are:

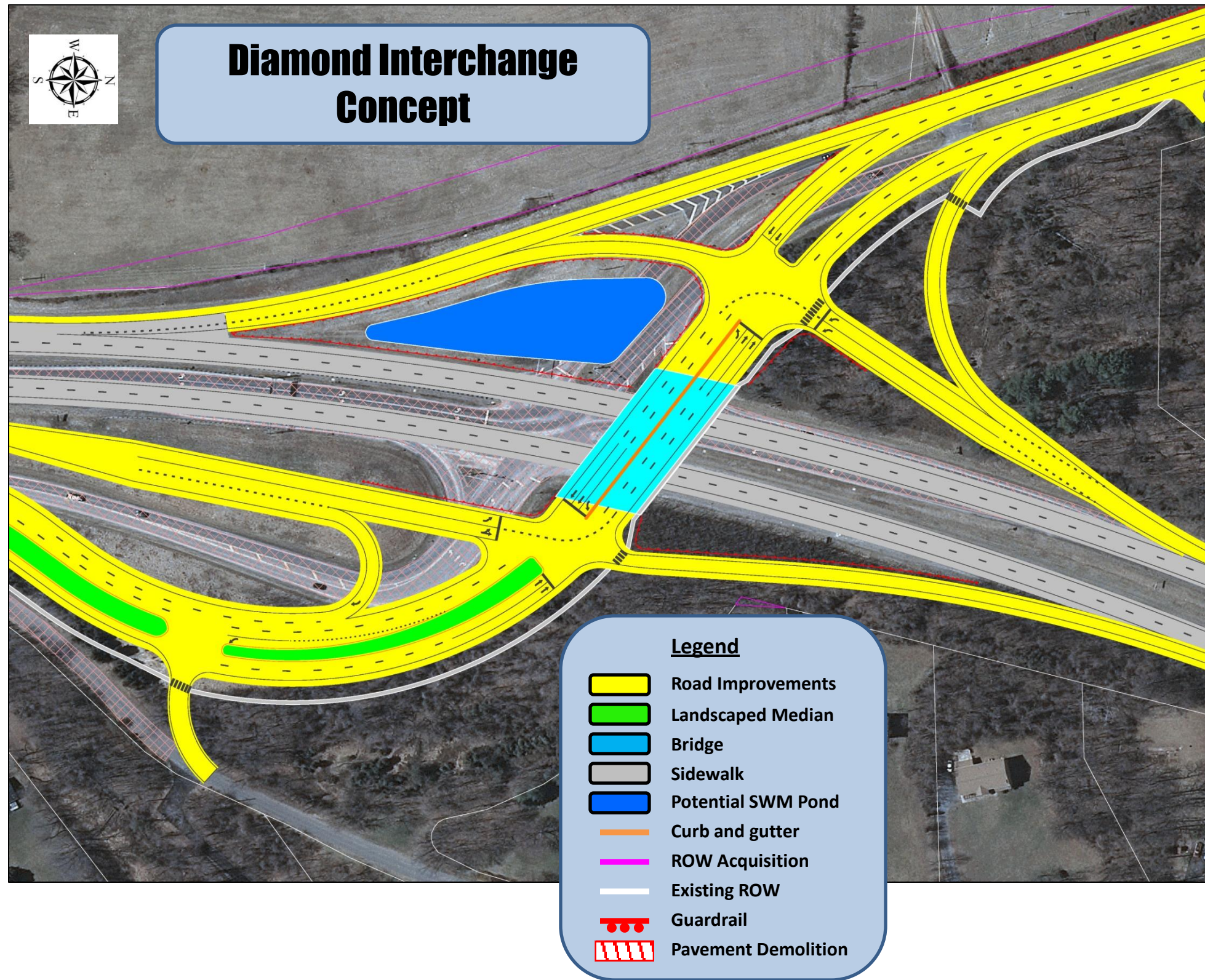


DIAMOND INTERCHANGE CONCEPT



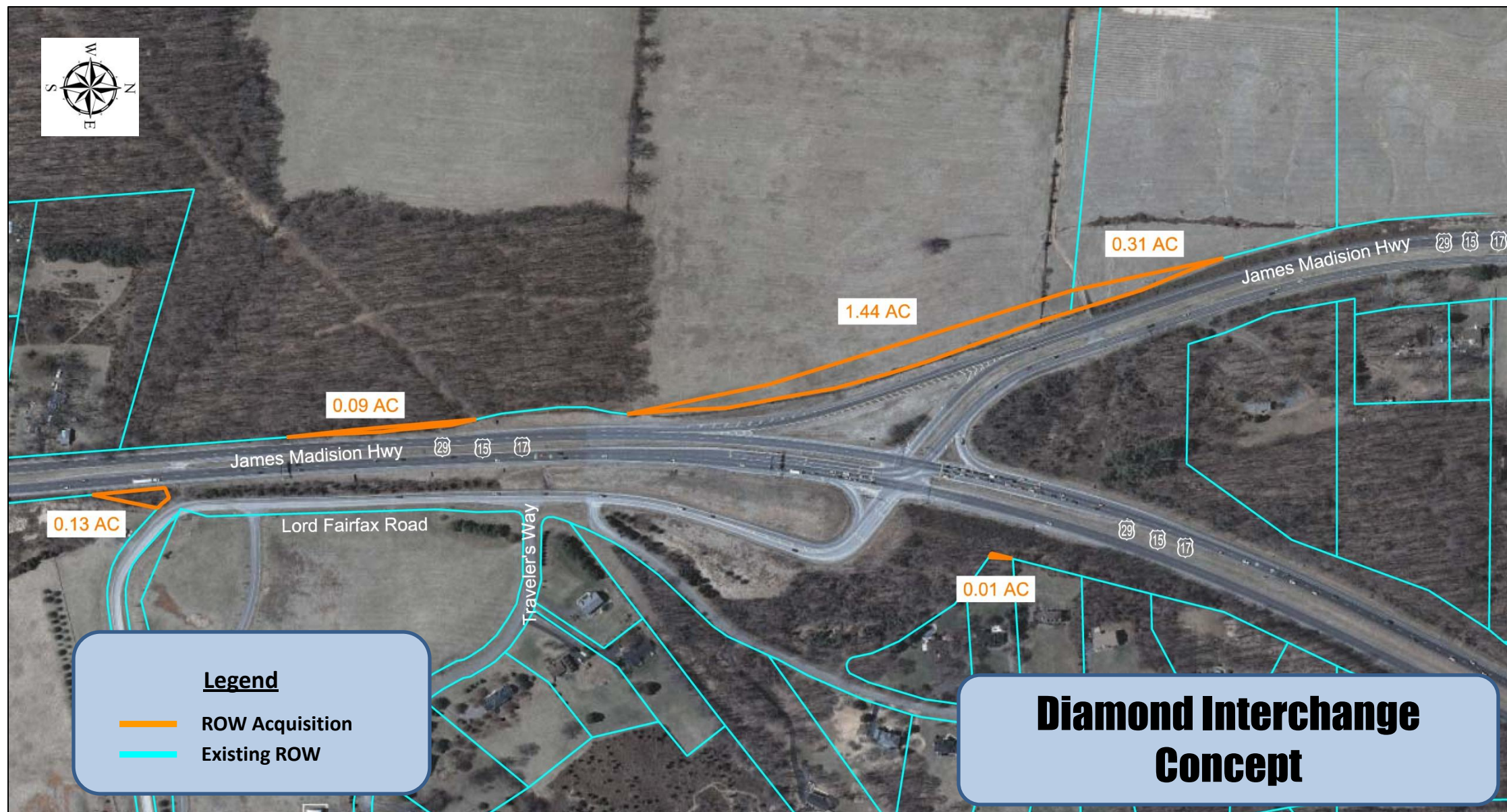
The **Diamond Interchange Concept** consists of:

- Removing the existing at-grade signalized intersection.
- Carrying Lord Fairfax Road over Route 29 Bypass on a six-lane bridge.
- Four ramps with Route 29 Bypass.
- Signalized intersections on either side of the cross street bridge at the ramp termini.
- 5-foot sidewalk on north side of interchange.



The **Diamond Interchange Concept** has the following operational characteristics:

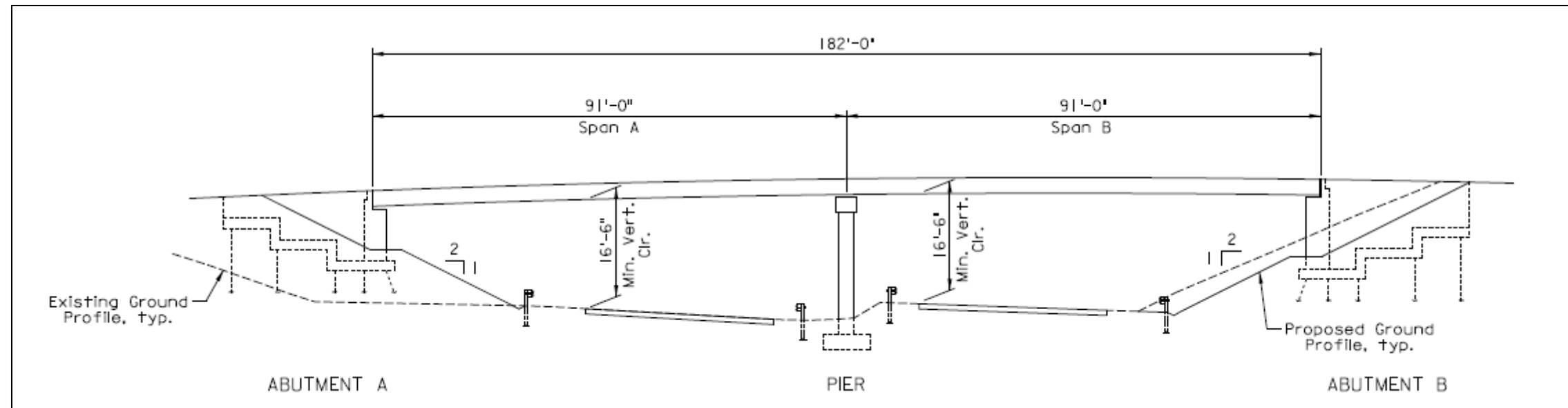
- Ramp termini will need to be signalized by opening day.
- The western Ramp termini intersection is expected to operate at LOS B or better for both AM and PM peak hours.
- The eastern Ramp Termini Intersection is expected to operate at LOS C or better for both AM and PM peak hours.
- Ramp junctions with Route 29 Bypass expected expected to operate at LOS C or better for AM peak hour and LOS C or better for PM peak hour with 2040 design volumes.



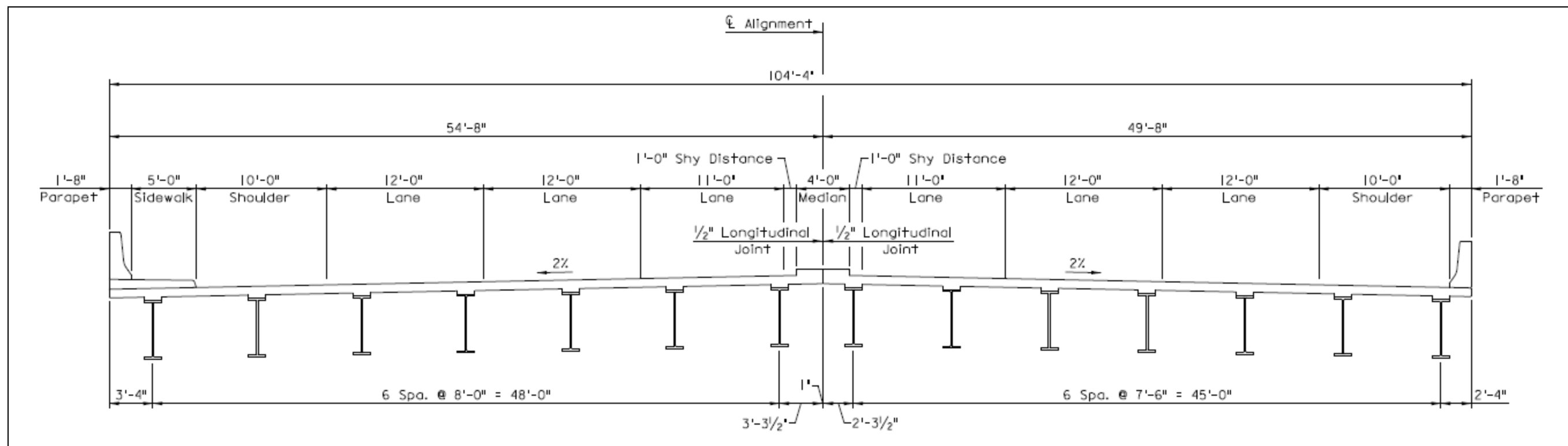
The **Diamond Interchange Concept** requires **1.98 acres** of right-of-way:

- Right-of-way based on Fauquier County GIS data.
- Retaining walls may be able to reduce acquisition needs.
- Construction easements could be used instead of ROW acquisition for detour roads during construction.

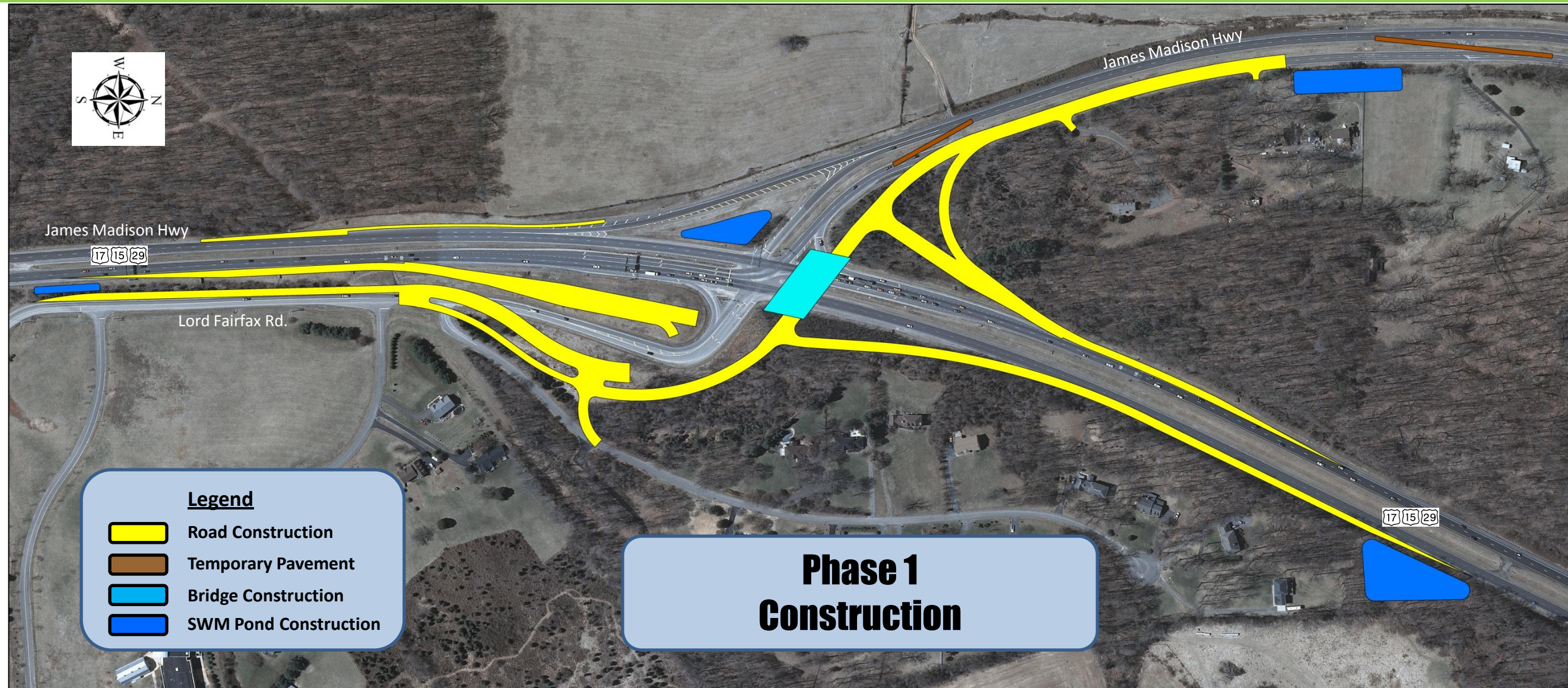
DIAMOND INTERCHANGE – BRIDGE DETAILS



Elevation – Looking North

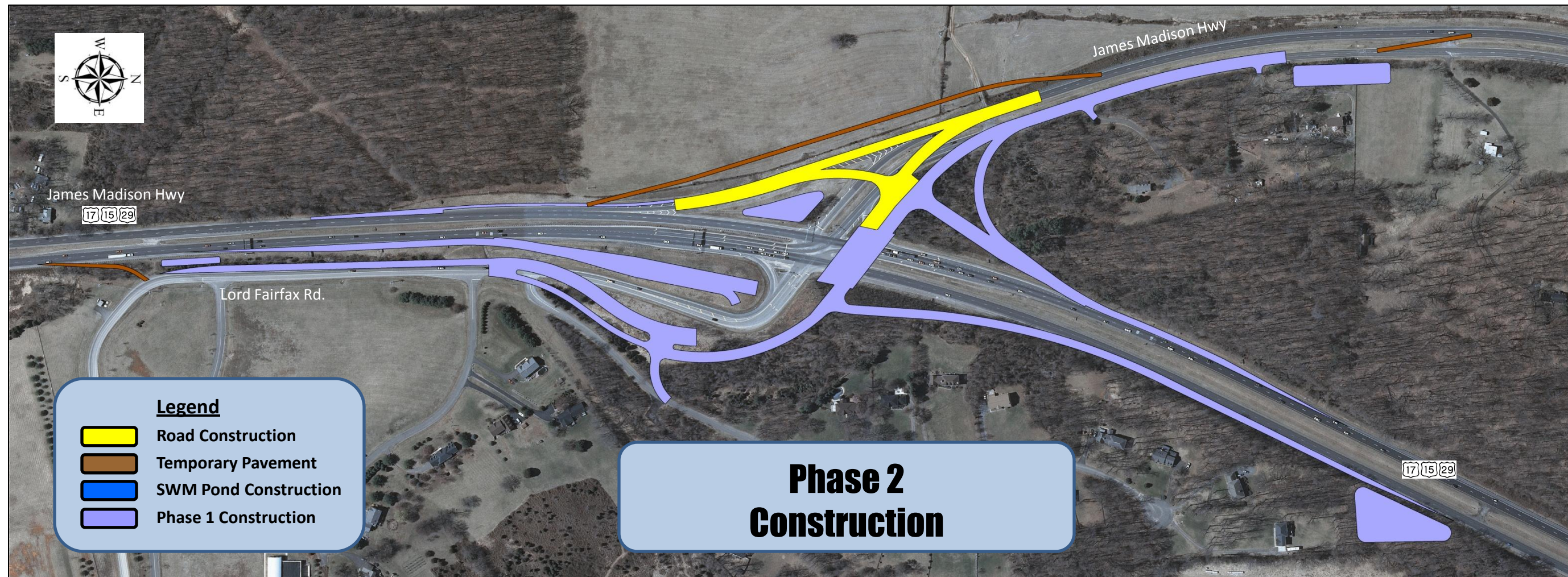


Typical Section - Looking East



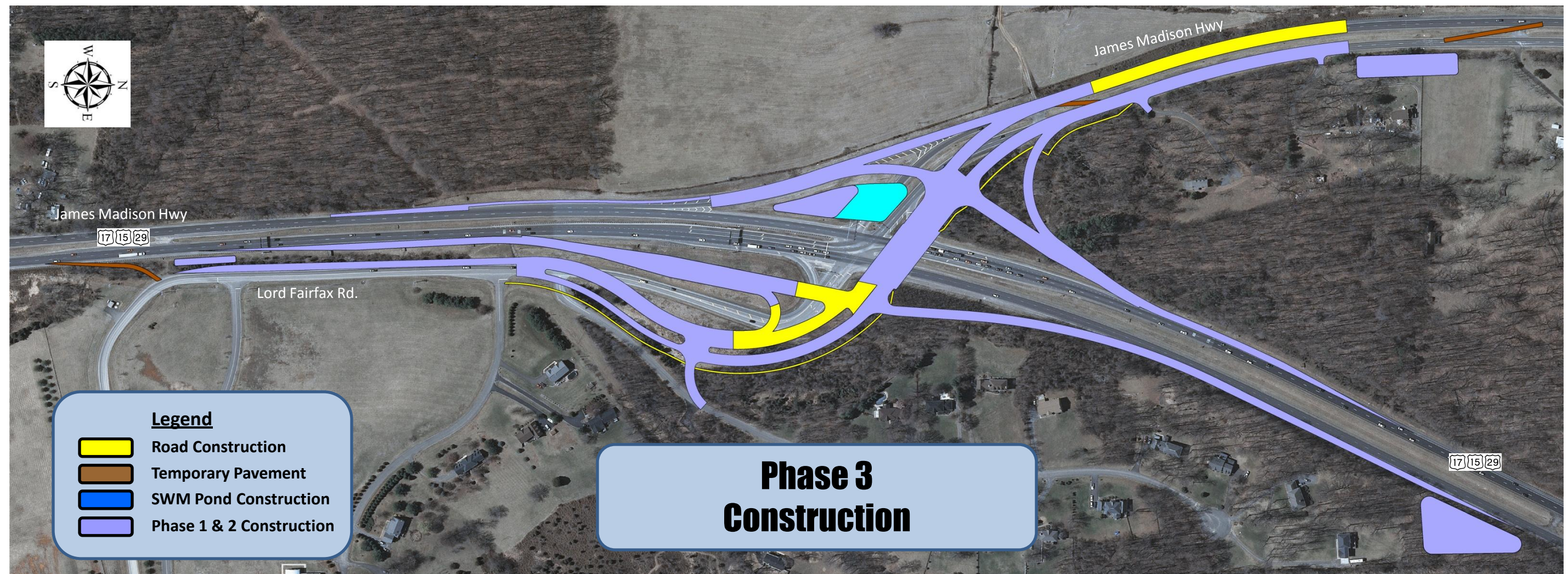
Phase 1 Construction:

- Maintain all traffic movements at existing signalized intersection.
- Divert WB Business Route 29/15/17 traffic to EB Business Route 29/15/17.
- Construct Bridge & SWM Ponds.
- Construct Westbound Lord Fairfax Road and WB Business Route 29/15/17.
- Construct SB off-ramp & NB on-ramp and a portion of the NB off-ramp & SB on-ramp.



Phase 2 Construction:

- Divert EB Business Route 29/15/17 traffic to WB Business Route 29/15/17.
- Divert EB Lord Fairfax Rd traffic to WB Lord Fairfax Road & utilize SB off-ramp & NB on-ramp
- Maintain WB to SB left turn movement at existing signalized intersection.
- Detour NB to WB and NB to EB traffic onto Lord Fairfax Rd prior to project area.
- Detour SB on-ramp traffic using temporary pavement.
- Construct SB on-ramp and a portion of EB Business Route 29/15/17.



Phase 3 Construction:

- Divert EB Business Route 29/15/17 traffic to WB Business Route 29/15/17.
- Divert EB Lord Fairfax Rd traffic to WB Lord Fairfax Road & utilize SB off-ramp, NB on-ramp & SB on-ramp
- Detour NB to WB and NB to EB traffic onto Lord Fairfax Rd prior to project area.
- Construct final portion of NB off-ramp and a portion of EB Business Route 29/15/17.
- Enlarge SWM pond.

Cost Estimate

Roadway & Drainage Costs:	\$ 9,500,000
Bridge Costs:	\$ 4,800,000
Miscellaneous (20%):	\$ 2,850,000
Contingency (10%):	\$ 1,450,000
Mobilization/Survey/MOT:	<u>\$ 2,400,000</u>
Base Estimate for Construction:	\$ 21,000,000
Right-of-way/Utilities:	\$ 200,000
Construction Engineering (15.5%):	\$ 2,900,000
Preliminary Engineering:	<u>\$ 2,000,000</u>
TOTAL PROJECT COSTS:	\$ 26,100,000

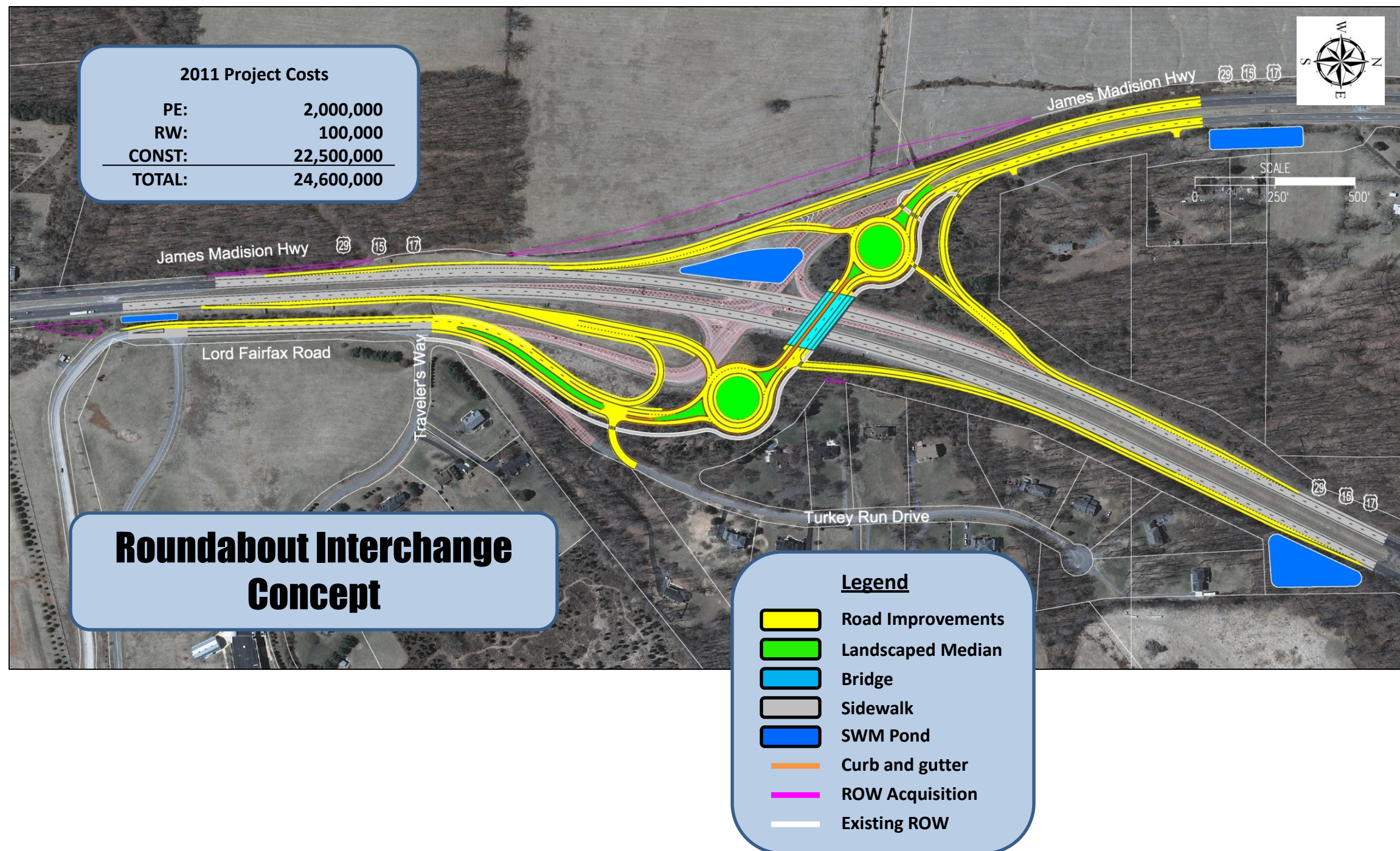
Assumptions

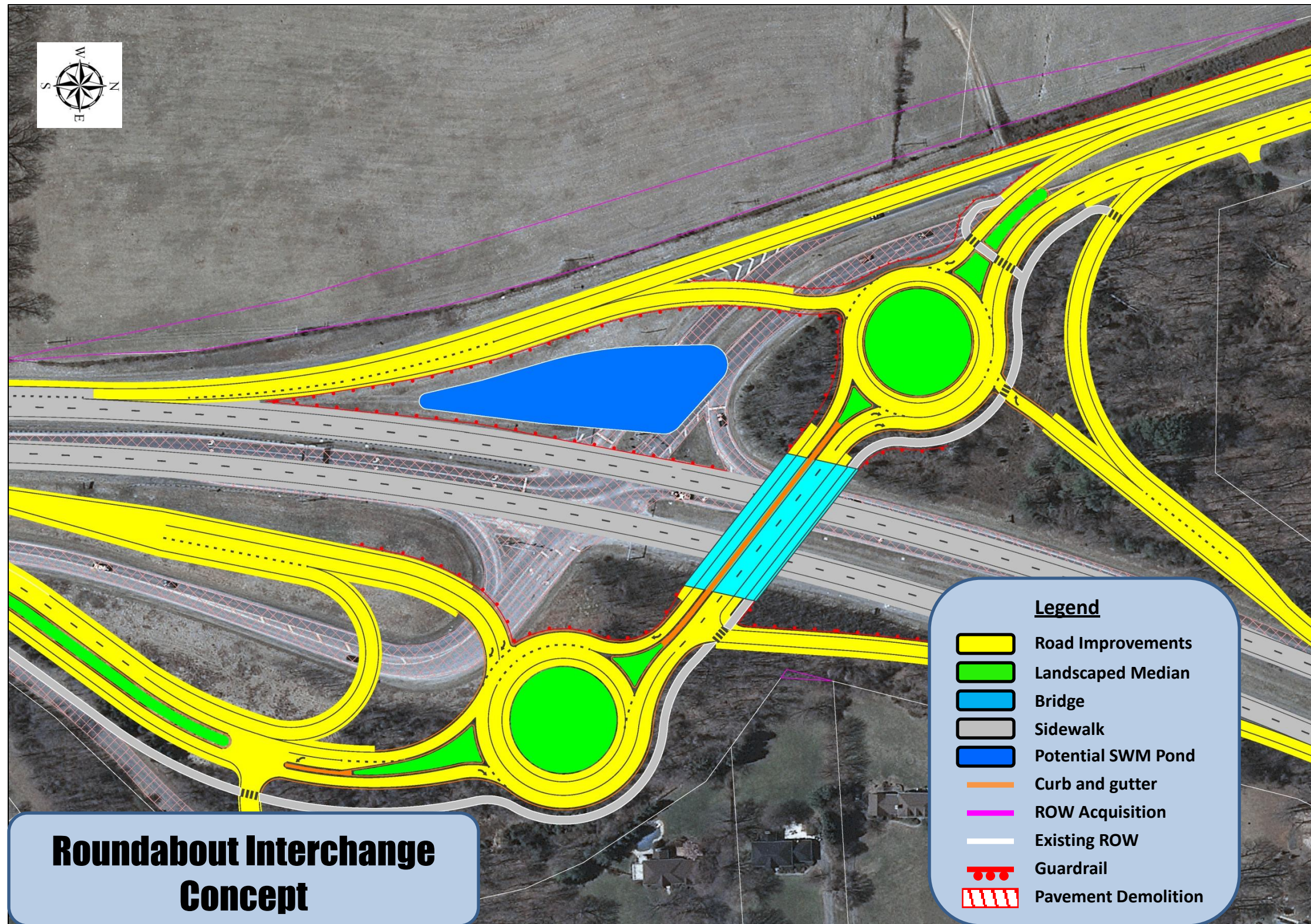
- VDOT Culpepper District Average Unit Costs 2009-2011
- Bridge Costs = \$250 SF
- Pavement Section: 2.0" Surface Coarse + 4.0" Intermediate Coarse + 7.0" Base Mix + 8.0" Subbase Aggregate.
- Miscellaneous – 20%
- Contingency – 10%
- ROW Costs = 140% of assessed land value + \$15,000 admin fees per parcel.
- Utility Adjustments minimal – project passes over water line and gas line easement as does the existing road.

ROUNABOUT INTERCHANGE CONCEPT

The **Roundabout Interchange Concept** consists of:

- Removing the existing at-grade signalized intersection.
- Carrying Lord Fairfax Road over Route 29 Bypass on a three-lane bridge.
- Four ramps with Route 29 Bypass.
- Roundabouts on either side of the cross street bridge at the ramp termini.
- Multi-use Path on north side of interchange.

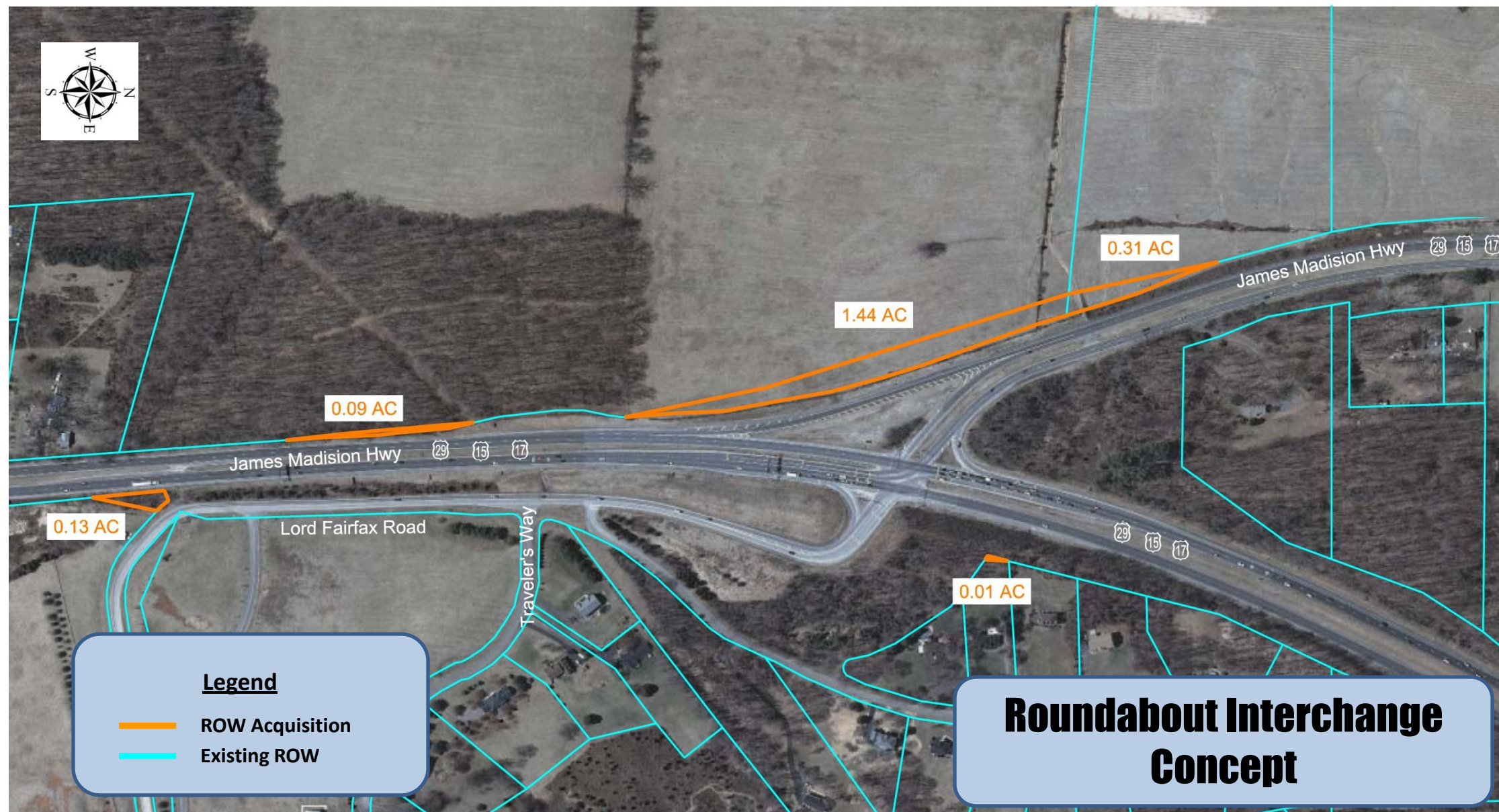




The **Roundabout Interchange Concept** has the following operational characteristics:

- Ramp termini intersections expected to operate at LOS C or better for AM peak hour and LOS C or better for PM peak hour with 2040 design volumes.
- Ramp junctions with Route 29 Bypass expected to operate at LOS C or better for AM peak hour and LOS C or better for PM peak hour with 2040 design volumes.

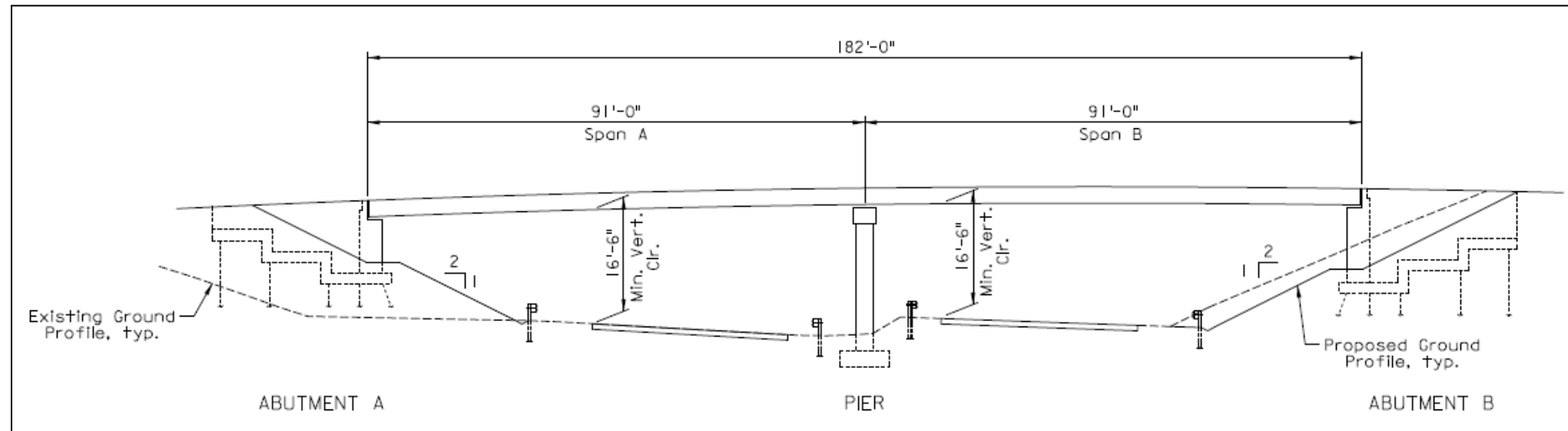
ROUNABOUT INTERCHANGE RIGHT OF WAY NEEDS



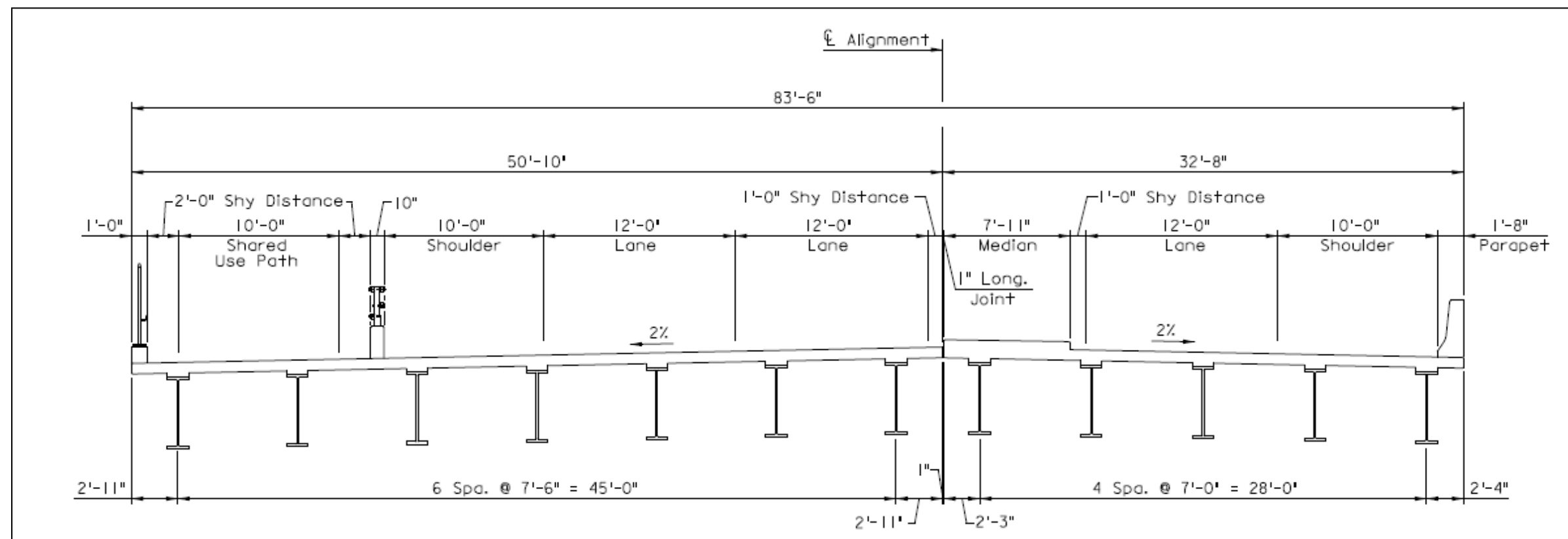
The **Roundabout Interchange Concept** requires **1.98 acres** of right-of-way:

- Right-of-way based on Fauquier County GIS data.
- Retaining walls may be able to reduce acquisition needs.
- Construction easements could be used instead of ROW acquisition for detour roads during construction.

ROUNABOUT INTERCHANGE – BRIDGE DETAILS



Elevation – Looking North

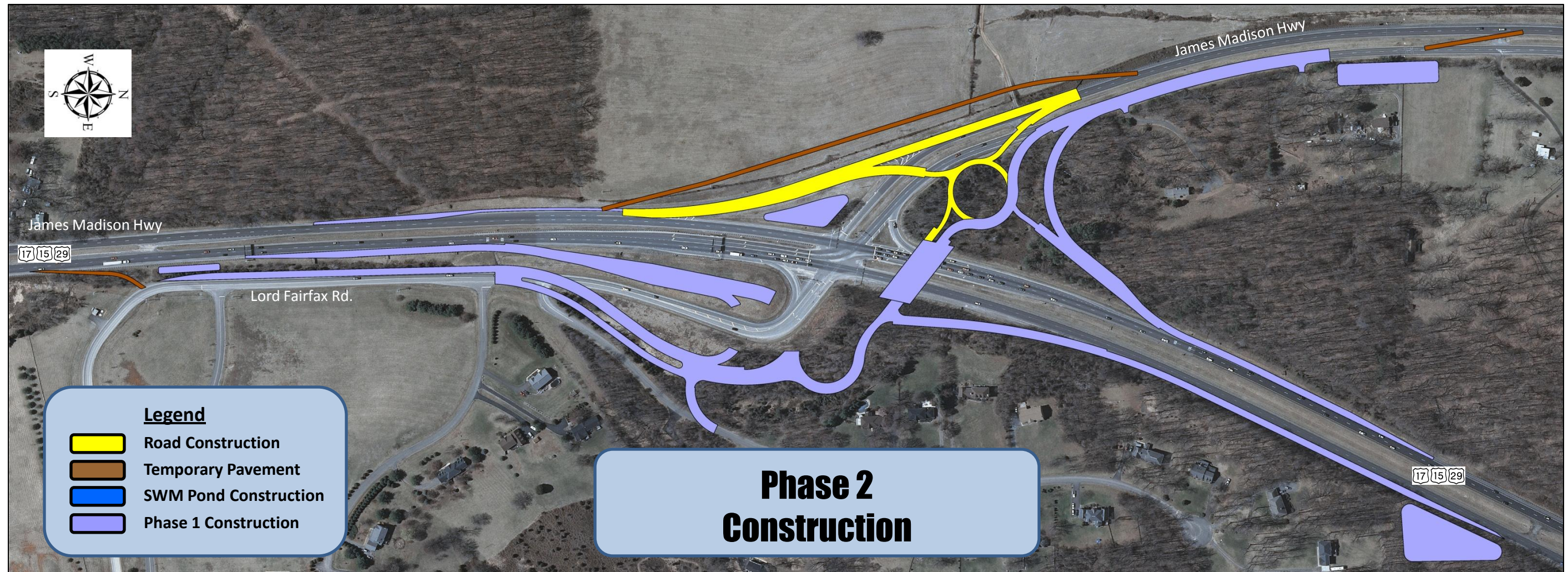


Typical Section - Looking East



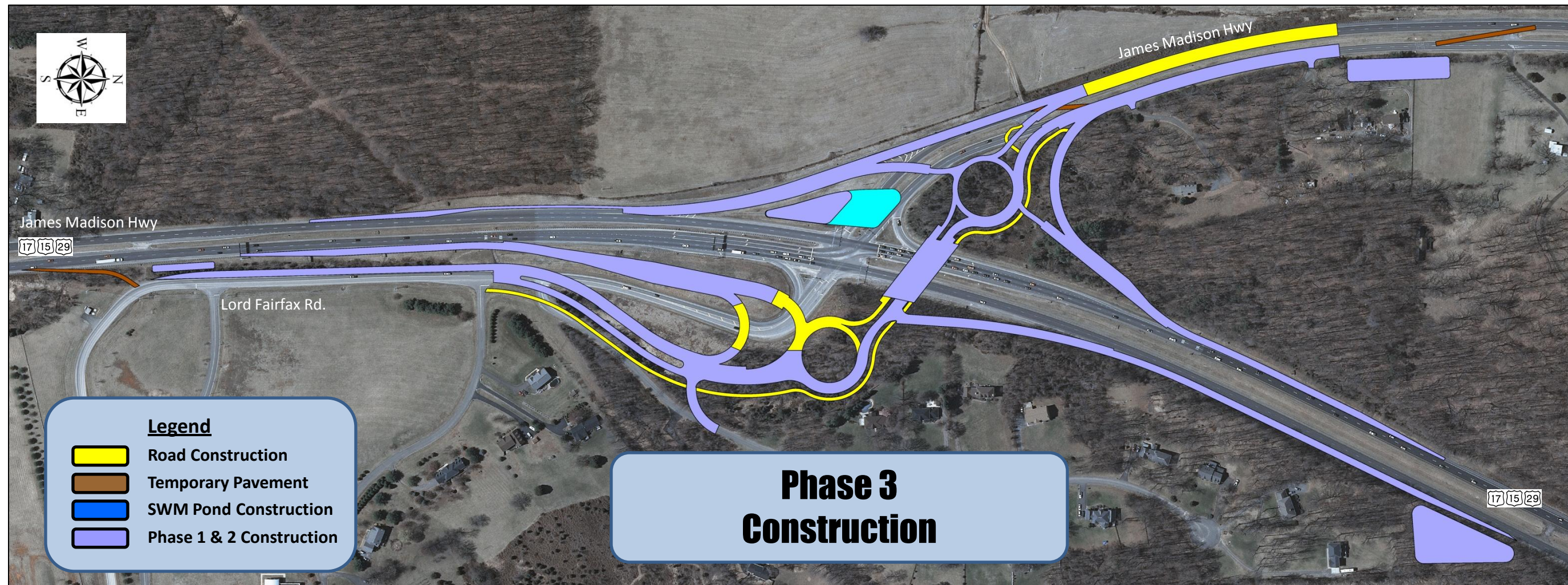
Phase 1 Construction:

- Maintain all traffic movements at existing signalized intersection.
- Divert WB Business Route 29/15/17 traffic to EB Business Route 29/15/17.
- Construct Bridge & SWM Ponds.
- Construct Westbound Lord Fairfax Road and WB Business Route 29/15/17.
- Construct SB off-ramp & NB on-ramp and a portion of the NB off-ramp & SB on-ramp.
- Construct north half of both roundabouts



Phase 2 Construction:

- Divert EB Business Route 29/15/17 traffic to WB Business Route 29/15/17.
- Divert EB Lord Fairfax Rd traffic to WB Lord Fairfax Road & utilize north side of roundabouts
- Maintain WB to SB left turn movement at existing signalized intersection.
- Detour NB to WB and NB to EB traffic onto Lord Fairfax Rd prior to project area.
- Detour SB on-ramp traffic using temporary pavement & utilize NB on-ramp and SB off-ramp.
- Construct SB on-ramp, a portion of EB Business Route 29/15/17 including finishing west roundabout.



Phase 3 Construction:

- Divert EB Business Route 29/15/17 traffic to WB Business Route 29/15/17.
- Divert EB Lord Fairfax Rd traffic to WB Lord Fairfax Road & utilize SB off-ramp, NB on-ramp & SB on-ramp.
- Detour NB to WB and NB to EB traffic onto Lord Fairfax Rd prior to project area.
- Construct final portion of NB off-ramp including finishing east side roundabout and a portion of EB Business Route 29/15/17. Enlarge SWM pond.

Cost Estimate

Roadway & Drainage Costs:	\$ 9,500,000
Bridge Costs:	\$ 3,800,000
Miscellaneous (20%):	\$ 2,650,000
Contingency (10%):	\$ 1,350,000
Mobilization/Survey/MOT:	<u>\$ 2,400,000</u>
Base Estimate for Construction:	\$ 19,700,000
Right-of-way/Utilities:	\$ 200,000
Construction Engineering (15.5%):	\$ 2,700,000
Preliminary Engineering:	<u>\$ 2,000,000</u>
TOTAL PROJECT COSTS:	\$ 24,600,000

Assumptions

- VDOT Culpepper District Average Unit Costs 2009-2011
- Bridge Costs = \$250 SF
- Pavement Section: 2.0" Surface Coarse + 4.0" Intermediate Coarse + 7.0" Base Mix + 8.0" Subbase Aggregate.
- Miscellaneous – 20%
- Contingency – 10%
- ROW Costs = 140% of assessed land value + \$15,000 admin fees per parcel.
- Utility Adjustments minimal – project passes over water line and gas line easement as does the existing road.